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ABSTRACT

The purpose of this study was to assess the effects of real and nonsense pictures with no labels, high-frequency labels, or low-frequency labels in discrimination learning of young children. The subjects were 102 second-grade children randomly selected from several classrooms located in a semi-rural community in Wisconsin. The subjects were assigned to one of six experimental conditions: real pictures with no labels provided; nonsense pictures with either no labels, high-frequency labels, or low-frequency labels provided; and high-frequency and low-frequency printed words. Thirteen pairs of pictures of words, established in a norming study, were utilized in each condition. Each subject was tested individually in a vacant classroom. The results indicated that the picture-over-word effect was operating. There was a slight increase in performance due to labeling the nonsense type picture. However, there was little or no indication of a word-frequency effect. (WR)

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Technical Report No. 331

THE EFFECTS OF LABELING AND MEANINGFULNESS ON CHILDREN'S PICTORIAL DISCRIMINATION LEARNING

by

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Report from the Project on
Children's Learning and Development

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ABSTRACT

The purpose of the experiment was to assess the effects of real and nonsense pictures with no labels, or high- or low-frequency labels in discrimination learning of young children (second graders). In general, it was found that the picture-over-word effect was operating, although not as strongly as in previous research with older subjects. There was a slight increase in performance due to labeling the nonsense type pictures, however, there was little or no indication of a word-frequency effect (low- over high-frequency words).

The implications of the results were discussed in conjunction with additional data with fourth-grade children. With these older children the frequency effect was demonstrated.

Chapter 1

REVIEW OF THE LITERATURE AND STATEMENT OF THE PROBLEM

Discrimination learning has been in the psychological literature for many years. Spence (1936) made one of the major contributions in defining a theory of discrimination learning founded on "overlapping gradients of generalization, a gradient of excitatory strength from the reinforced member of the training pair and a gradient of extinction from the negative pair" (Spence and Hull, 1970, p. 215). In thirty years or so discrimination learning has been investigated with both rats and humans. One paradigm of recent interest consists of human discrimination learning among verbal stimuli and is known as a "verbal discrimination" task (see Wallace, 1972). This paradigm has become a standard task for the investigation of a form of recognition memory. The basic procedure consists of the presentation of pairs of items with one member in each pair designated as the "correct" item. The task confronting the subject is quite simple. As each pair of items is presented, the experimenter informs the subject which is the correct member of the pair. Learning is demonstrated by a gain in the number of correct responses over trials or by the number of trials required to reach a specific criterion.

Words Versus Pictures

Recently the "verbal discrimination learning" task has been extended to that of pictorial materials. Since other recognition memory tasks have found a superiority of pictorial over verbal materials with both adults (Shepard, 1967; Standing, Conezio, and Haber, 1970) and children (Brown and Scott, 1971; Corsini, Pick, and Flavell, 1968), the question arose:

Would the same findings hold in the discrimination task? Goulet and Sterns (1970) compared line drawings of common objects and their corresponding verbal labels in a sample of fourth grade children. In this particular experiment it was found that the word lists were learned faster than the pictures. However, a comparison of pictures and words as stimuli in discrimination learning was also reported by Rowe and Paivio (1971), using high school students as Ss. Their results were in complete opposition to those of Goulet and Sterns, pictures being significantly superior to words. Furthermore, Rowe (1972) replicated the picture superiority in three discrimination learning experiments with college students as well as with fourth graders as Ss. Additional experiments also rendered Goulet et al.'s findings suspect. For example, Wilder and Levin (1973) with college and fifth grade Ss, and Ghatala, Levin and Makoid (in press) with elementary school children, have substantiated the superiority of pictures in discrimination learning. Initial attempts to explain such effects have been given by Paivio and Rowe (1970) and Rowe and Paivio (1970) in terms of imagery/concreteness (see also Paivio, 1971). However, recently it has been argued (Ghatala and Levin, 1974) that picture-over-word effects may be regarded as a manifestation of more general stimulus materials differences, all of which seem to be reasonably incorporated into the "frequency theory" of verbal discrimination learning initially proposed by Ekstrand, Wallace, and Underwood (1966).

The Frequency Theory of Discrimination Learning

Basically, frequency theory assumes that the cue for discrimination is the difference in "subjective frequency" (essentially, a difference in acquired familiarity) between the correct and incorrect alternatives of a verbal pair. Ekstrand et al. (1966) speculated that the accrual of subjective

frequency to items in a pair might be influenced by the items' background frequency (or pre-experimental experience) in a manner somewhat similar to that prescribed by Weber's psychophysical law: that adding a frequency unit (i.e., experimentally, as a result of it being "correct") to an item already high in background frequency (e.g., a high-frequency word) would be less noticeable than adding a frequency unit to an item low in frequency (e.g., a low-frequency word). In other words, by dichotomously classifying items as being of "high" or "low" background frequency, an abstraction of the law would predict that situational frequency discriminations would be easier for items low in background frequency than for those high in background frequency. However, until recently relatively little empirical research has been conducted in the way of validating Ekstrand et al.'s (1966) speculations.

Background Frequency Differences in Discrimination Learning

While several experiments have demonstrated that low-frequency word pairs are discriminated better than high-frequency word pairs (e.g., Rowe, et al., 1971; Underwood, Broder, and Zimmerman, 1973) others have not (e.g., Ingison and Ekstrand, 1970; Kaivio and Rowe, 1970). Ghatala and Levin (1974) have suggested that these discrepancies may be due to the operation of another factor which they have termed "meaningfulness" -- not in the formal verbal learning sense (see Underwood & Schulz, 1960), but rather in terms of Ss' knowledge of the meanings of low frequency items. They found that subjective frequency differences between high- and low-frequency words for which Ss knew the meanings were in accordance with the predictions of frequency theory and Weber's law (i.e., superior performance with low-frequency words). However, when lists contained low-frequency words that were "nonmeaningful" but comparable in terms of their average normative

frequencies (Thorndike-Lorge, 1944) there was significantly poorer performance, relative to high-frequency words. It seems that Weber's law holds for materials which are meaningful to Ss but not for materials which are not meaningful.

It has been proposed (cf. Ghatala, Levin, and Wilder, 1973) that picture-word differences in recognition and discrimination tasks may also be accounted for in terms of differences in background frequency. That is, pictures or line drawings used in experiments, while representing common, familiar objects are in themselves relatively novel stimuli in that Ss have more than likely never encountered the particular picture or line drawing in the past (essentially, zero background frequency). On the other hand, words (or labels for the pictured objects) have probably been encountered by Ss many times in their past experience.

Picture-Word Differences and Apparent Frequency

The correctness of the above hypothesis aside, several studies have demonstrated that pictures and words do indeed differ in apparent frequency and that these apparent frequency differences are directly related to discrimination learning differences. For example, in a frequency judgment task, Ghatala et al. (1973) found that Ss' apparent frequencies for pictures were higher than for words, the variability of these judgments was lower for pictures than for words, and there were fewer false alarms for items not presented on the study trial for pictures than for words.

Although mean apparent frequency was reliably higher for pictures than for words there was some overlap in the two distributions, something capitalized on by Levin, Ghatala, and Wilder (1974) in a followup study. The usual picture-over-word effect in discrimination learning was observed when mean apparent frequency differences between pictures and words were

maintained. But when the extremes of the two distributions (words with high apparent frequencies and words with low apparent frequencies) were selected to equate pictures and words in terms of their mean apparent frequencies, no discrimination learning differences between the two types of materials were detected. One of the major questions of interest for the present experiment is whether this finding will hold when one varies the meaningfulness of a picture. It would seem that meaningfulness may well be a crucial variable when investigating the effects of background frequency in discrimination learning of pictorial as well as verbal materials.

Introduction to the Present Study

In an experiment combining modes (words versus pictures) and frequency of the labels (high versus low), Ghatala et al. (in press) found that pictures were superior to words in both discrimination and free-recall tasks whereas the frequency effect reversed in the two tasks: high-frequency stimuli were superior to low-frequency stimuli in free recall, and low-frequency stimuli were superior to high in discrimination learning. Moreover, there was no frequency by mode interaction found in either the free-recall or the discrimination task, thereby suggesting that the label's frequency may be relevant to the learning of pictorial materials as well as verbal materials. However, it is difficult to determine from this experiment the locus of the frequency effect; that is, whether it was the pictures' labels that were contributing to the effect or rather the fact that objects with high-frequency labels occur frequently in real life, and those with low-frequency labels do not. The present experiment consists of a first step in evaluating the effects of certain stimulus variables on children's discrimination learning of pictorial and verbal materials. Such variations included the "background

frequency" of the verbal labels ascribed to the pictures, that is, the pre-experimental frequency with which the particular labels appeared in print for children [as determined by Carroll, Richman, and Davies' (1971) word frequency norms]; as well as the meaningfulness of the pictorial representations [as determined by local ratings for materials ranging from easily recognizable line drawings to essentially nonsense drawings similar to those employed previously by Kingsley and Hagen (1969)].

Although there have been a number of studies addressing the question of labeling (see Bernbach, 1967; Bush and Cohen, 1970; Goulet and Hoyer, 1973; Milgram and Furth, 1963; Ward, 1971) the most relevant for present purposes are those by Hagen and his associates. Experiments by Kingsley and Hagen (1969) found that nursery school children benefitted from labeling when required to remember the position of items in a series. In this study the stimulus materials consisted of "nonsense" or "difficult-to-label" line drawings [developed by Glucksberg and Krauss (1967)] and the investigators were concerned with the effect of adding labels to these figures (which, as just noted, was facilitative). For older children (grades 4, 6, and 8) and college students, Hagen, Meacham, and Mesibov (1970) found, however, that labeling of line drawings of common objects can be detrimental, perhaps by preventing the subject from engaging in other mnemonic activities such as spontaneous rehearsal.

In the present context, would the provision of a label to second grade children enhance the meaningfulness of relatively nonmeaningful material (thereby improving discrimination learning)? And does the type of label provided (i.e., high- or low-frequency) make a difference?

The present study is an attempt to examine the effect of the meaningfulness and background frequency dimensions on pictorial discrimination

learning, in order to determine whether their respective roles are comparable to those in verbal discrimination learning. Second-grade children were selected since it was desired that subjects would be young enough that the possibility of their spontaneously labeling the nonsense materials would be minimized and yet old enough to know the meanings of the low-frequency labels.

In particular, the three major questions are: (1) As pictorial materials become "meaningless" (in the sense of unfamiliar, "nonsense" figures) will discrimination learning performance deteriorate? (2) Will providing labels improve performance by rendering the materials more meaningful? and (3) Given similar high-frequency and low-frequency (but meaningful) labels for the same stimuli, will those labeled with the latter produce superior discrimination learning, as they do for verbal stimuli?

Chapter II

NORMING STUDY

The purpose of the norming study was to determine the adequacy of the materials, as determined from the following three criteria: (1) that there be an agreement between Carroll et al. (1971) norms and the word experiences of semi-rural children from the Midwest; (2) that the words employed were meaningful to such Ss; and (3) that the "nonsense" pictures were identifiable when Ss were given high-frequency labels for them. Materials were eliminated if they did not meet with all of the above specifications to a high degree.

Subjects

Sixty second grade children from a semi-rural community in Wisconsin were used in the norming study.

Materials

Pairs of words with similar referents (or referents from the same general class of objects) but differing in background frequency were selected from the Carroll et al. (1971) word frequency norms for children. These norms are based on a total corpus of 5,088,721 tokens. The F value (the number of occurrences of the particular word type in the total corpus) was used as the basis for word selection. This particular value was chosen because these norms only go down as far as third grade level and in this study second grade children were utilized as subjects. This F value represents an overall value of children's experience with each particular word in print based on computer-assembled selection of words drawn in 500-word samples from 1,045 published materials for children of various grade levels. The high frequency words were selected from a range of 138 to 2,705 occurrences

(median = 421) of the particular word type in the corpus. The range of the low-frequency words was from 3 to 121 occurrences (median = 50).

Procedure

The children were divided into two groups, thirty of whom were asked to judge which of a pair of words (that differed in frequency but had the same or a similar referent) they had "heard, seen, or used more often" for each of several pairs of words (e.g., ghost-phantom; pot-kettle). This was done to assure that the high-frequency and low-frequency labels generated from the Carroll et al. (1971) frequency norms corresponded to our (Wisconsin semi-rural community) subjects' experience with such labels.

The other thirty subjects were given a series of four arrays with 7 to 8 four inch line drawings of common objects per array and were asked to point to the picture when given its low-frequency label. This was done to assure that the low-frequency labels were meaningful and corresponded to the appropriate objects (e.g., that Ss would point to a pair of eyeglasses when given the label "spectacles").

Twelve "difficult-to-label" pictures (see Glucksberg and Kraus, 1967; Kingsley and Hagen, 1969) were developed on the basis of earlier pilot work and norming. Eighteen additional difficult-to-recognize or "nonsense" pictures were included to be normed with these latter 30 children. The same procedure was utilized as with the previous norming of the other 12 pictures. Specifically, each subject was asked to try to give an appropriate label for the picture if it had to be labeled. Secondly, each subject was given labels for the pictures and was asked if the label was a good thing to call the particular picture. Responses were evaluated on a 3-point scale of agreement. In the second task, subjects were given both reasonably appropriate and inappropriate labels (counterbalanced across subjects) to control for

response bias or guessing. All of the line drawings of common objects that were easy-to-recognize had been used in previous experiments.

Words were accepted for use if the subjects' judgments of their background frequencies were at least 77% in agreement with the Carroll et al. (1971) norms. Easily recognizable pictures were accepted if at least 80% of the subjects were able to match them given their low-frequency labels. The difficult-to-recognize pictures were accepted if at least 80% of the subjects rated the appropriate high-frequency label as being a good thing to call the particular picture; and that given an inappropriate high-frequency label 80% of the subjects would have to agree that it was not a good thing or a silly thing to call the picture. In order for an item to be used in the experiment all of the above criteria had to be met.

According to this procedure thirteen pairs of items were selected for experimental use. Each item consisted of a real picture, a difficult-to-recognize picture, and its high- and low-frequency label (see Appendix A for examples of each).

Chapter III

METHOD

Subjects

The subjects were one hundred and two second-grade children (different from those used in the norming study) randomly selected from several classrooms located in a semi-rural community in Wisconsin. Seventeen subjects were assigned randomly to each of the six conditions represented in Table 1.

Design

There were three types of stimuli in the study: easily recognizable ("real") line drawings; difficult-to-recognize ("nonsense") line drawings representing the same objects; and printed words. These stimuli combined with the type of verbal label provided produced six experimental conditions: "real" pictures with no labels provided; "nonsense" pictures with either no labels, high-frequency labels or low-frequency labels provided; and high-frequency and low-frequency printed words. A comparison of unlabeled "real" and "nonsense" pictures represents an attempt to examine the effect of meaningfulness on pictorial discrimination learning. As mentioned earlier, the meaningfulness of the stimuli has been found to affect verbal discrimination learning (Ghatala et al., in press). A high-frequency label added to the "nonsense" condition was an effort to increase meaningfulness by giving the stimuli appropriate names. The high-frequency and low-frequency labels in combination with the "nonsense" drawings were employed to see whether the low-frequency labels affected the discrimination learning of the "nonsense" drawings as they had improved the discrimination learning of "real" pictures in the earlier study (Ghatala et al., in press).

Table 1.

Design of the Experiment

	Real Pictures	Nonsense Pictures			Words	
Labels	None	None	High Frequency	Low Frequency	High Frequency	Low Frequency

Materials

Thirteen pairs of pictures or words, established in the norming study, were utilized in each condition. The pictures, both real and nonsense, were reproduced on white paper cut to approximately 4" by 5" and were attached in pairs to a 9" by 11" manila page in a ring notebook. Each page had tabs adhered to the top for ease in turning pages. The words were typed in primary type, all capitals, on 3 1/2" by 1" white labels which were also attached in pairs to a 9" by 11" manila page in a ring notebook. Three notebooks, for the three types of stimuli, were used in the experiment.

Each notebook contained an example of the appropriate stimulus type to indicate to the subject the format of each item to be presented. First a pair was presented, and then the page was turned, showing the same two items (in the same position) with a red metalic star beneath the correct response. In the example pair, the same pair would again be presented (in the same position) without the star and the subject was asked to point to the item designated as being correct. This was done to insure that the subject understood the procedure. In the experimental trials (study trial and two anticipation trials), a different pair would be presented in the same manner. In each experimental trial pairs were assigned randomly for position in the list and for position of each item within a pair.

Procedure

Each subject was tested individually in a vacant classroom in the school building. The subject was seated beside the experimenter who presented the pairs in the list by turning the pages in the looseleaf notebook. Each pair was shown for approximately five seconds. This timing was accomplished after much practice by the experimenter with a second hand on a watch. Then the same pair was immediately shown again for approximately five seconds with

the correct item indicated by a red star placed below it. Each subject received an example pair, followed by one study trial containing the thirteen pairs during which he did not respond, and then two anticipation trials. In the labeling conditions for the nonsense pictures and for the words, the experimenter pronounced the label during the first presentation of each pair during the study and two anticipation trials. Thus, Ss heard each label a total of three times. Conventional verbal discrimination instructions for the anticipation procedure were given in all conditions (differing slightly in the nonsense labeling conditions to indicate to the subject that he was going to be presented pairs of "things" and that the experimenter was going to tell him what these "things" were supposed to be). This was done to indicate to the subject that these "things" were not necessarily easily recognized in an attempt to control for the subjects spontaneously labeling these things. In the other conditions, instructions varied slightly with the materials (see Appendix B for verbatim instructions).

Following the verbal discrimination task each S was given the list of low-frequency words and asked to define each as best he could. These definition scores were used to determine which items these particular Ss did not know. Item pairs were eliminated (in the later analysis) if more than 20% of the Ss could not give a correct definition to at least one of the items in each pair. (See Appendix C for verbatim instructions.)

Chapter IV

RESULTS

All subjects in the experiment were administered two anticipation trials following one example and one initial study trial with no response required. The number of correct responses was summed across the two trials. This was done after items had been eliminated as a function of definition scores across Ss. (Two pairs out of the original thirteen pairs in the list were eliminated.) Thus, the scoring was based on eleven item pairs per trial.

Mean performances in three of the pictorial conditions are represented in Figure 1. To examine the relationship of picture meaningfulness (meaningfulness by real pictures or by adding a label to a nonsense picture) in verbal discrimination learning, the means in the "nonsense-high-frequency labeled" and "real" picture conditions were compared to the "nonsense-no-labeled" condition which served as a control by the application of Dunnett's test using a familywise error rate of .05 (one-tailed). The results of these comparisons are summarized in Table 2. Neither of the comparisons was significant.

Mean performance in the two labeled "nonsense" picture and two word conditions is presented in Table 3, where the effect of background frequency of the verbal labels and also the "picture"-over-word effect were analyzed by means of a 2 X 2 factorial design.

Neigher the frequency of the verbal label ($F = 1.77$, $df = 1/64$, $p < .05$), nor the interaction ($F = 3.77$, $df = 1/64$; $p < .05$) was significant in the analysis. However, there was some indication that the "picture"-over-word

Figure 1.

Mean Performance - Number of Correct Responses Over Two Trials
Three Pictorial Conditions

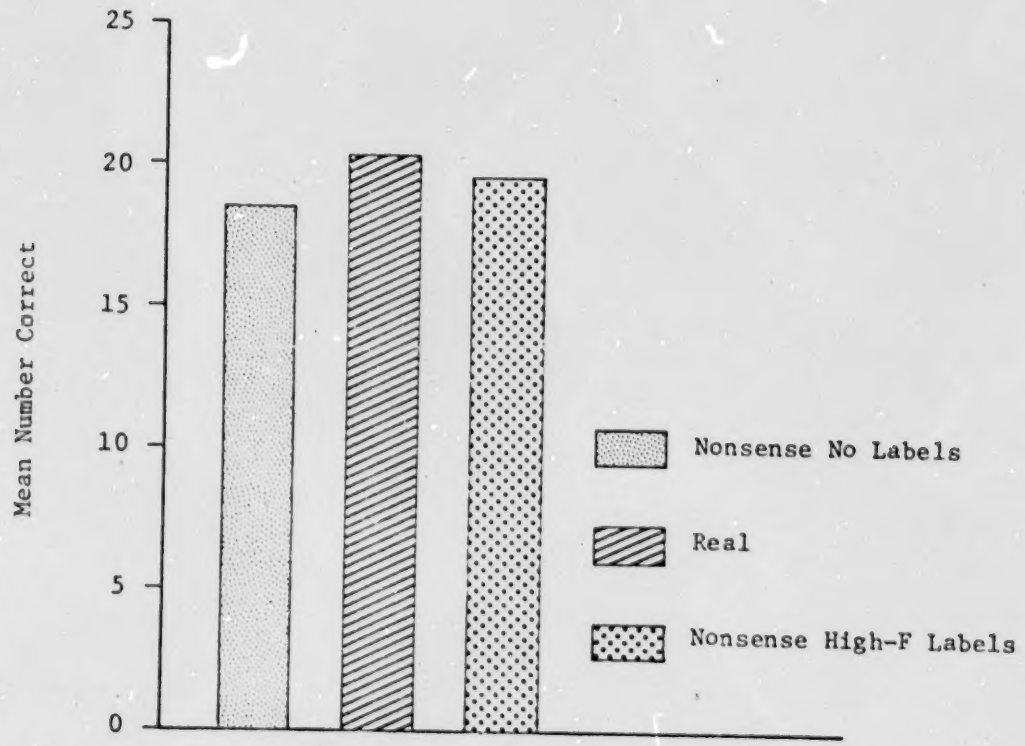


Table 2.

Summary of Dunnett's Individual Comparisons

Comparison	Observed Mean Difference	Critical Difference
Nonsense No Label versus Real	1.70	1.79
Nonsense No Label versus Nonsense High Label	.94	1.79

Note: The familywise Type I error probability for these two comparisons is .05.

Table 3.

Mean Number of Correct Anticipations As a Function of Mode and Frequency of the Stimuli

	Frequency		
	Low	High	Across Frequency
Mode			
"Pictures"	16.12	18.65	17.38
Words	16.18	15.70	15.94
Across Mode	16.15	17.17	

effect was operating in that a one-tailed test of the effect of "pictures" over word effect was significant (t = 1.86, df = 64; p < .05). This effect was also demonstrated by comparing mean performance in the "real" picture condition (19.41) with that of high-frequency words (15.70) (t - 4.07, df = 32; p < .05).

Additional Data

Since an earlier study demonstrated that background frequency is negatively related to discrimination learning (Ghatala et al., in press) and since it was not supported in this experiment, it was hypothesized that there was something unique about the present materials and/or the age of the present Ss (approximately two years younger than previously) that may be contributing to these results. Consequently, thirty-four fourth-grade children were selected from classes in the same semi-rural community in Wisconsin. Seventeen fourth-grade Ss were randomly assigned to each of two word conditions, high-frequency words and low-frequency words (consisting of the present materials). However, these conditions differed slightly from the original experiment by the addition of two pairs of items (previously piloted) in order to avoid ceiling effects with the older children. These additional items were not included in the scoring so that second-grade and fourth-grade scores were based on exactly the same items. (Item pairs eliminated by definition scores for the second grade were also not used in the scoring of the fourth grade.) The procedure was identical to that in the original experiment. In order to determine whether there was an effect of background frequency for the fourth graders a t-test was performed. The difference was significant (t = 2.47, df = 32, p < .05) in that the low-frequency stimuli ($\bar{X}$ = 18.24) were superior to the high-frequency stimuli ($\bar{X}$ = 15.47) in verbal discrimination learning.

Chapter V

DISCUSSION

Background Frequency Effects and Age

Recently the effect of background frequency in verbal discrimination learning has been investigated (see Ghatala et al., in press). However the results of this study with second-grade children did not establish that background frequency was a potent variable. To examine whether these findings were due to a stimulus-materials phenomenon or to a developmental one, fourth-grade children were given the same task for the high-frequency and low-frequency word conditions. With these children there was a definite background frequency effect, the low-frequency list being more easily discriminated that the high-frequency list. This was a consistent finding with previous research (Ghatala et al., in press).

Several suggestions may be applicable to this apparent developmental trend. One of the most straightforward explanations is that the effect of background frequency in verbal discrimination learning may become a more potent variable with increasing age. This follows a study by Ghatala and Levin (1973) on frequency judgments of children in kindergarten, third and fifth grades. Their findings clearly indicated that children's ability to encode and discriminate event frequency improved with age. They also made the assumption that for words there is an increasing amount of background or pre-experimental frequency accruing with age. In light of the present findings this seems to be the most viable explanation and deserves much consideration in future research.

Strategies, Rehearsal and Age

Much of the literature in the area of developmental change in memory and

learning phenomena has reported increases in rehearsal responses and the efficient usage of these responses with increasing age (see Flavell, 1970). Deichman, Speltz and Kausler (1971) have speculated (following Weber's law) that with items of high pre-experimental frequency the number of rehearsal responses required to provide correct discriminations is likely to be greater than with items of low frequency. They also predicted that with increasing age, increasing verbal experience with words should make the absolute number of pre-experimental responses to stimulus items greater for older than for younger children, and consequently, intra-pair discriminations should require more experimentally elicited rehearsal responses for older than for younger children. Older children are predicted not only to rehearse more but through their increasing verbal experience likely come to the discrimination task with a more clearly differentiated representation of high- and low-frequency words, thereby enabling them to discriminate low-frequency items more efficiently than high frequency items. This, too, is supported by the results of the present experiment.

Another explanation suggested for possible developmental trends in discrimination learning has to do with variations in strategies involved in approaching the task. Cross and Vaughter (1966) have suggested that very young children (CA = four years) respond in a two-choice object discrimination task by avoiding the non-reinforced (incorrect) stimulus rather than by approaching the reinforced (correct) stimulus. Carmean (1969) has demonstrated that it is possible with first-, third-, and sixth-grade children to facilitate or to depress the learning of a group of two-choice discriminations of line drawings by controlling their pattern of post-response activity--in this case the activity was naming. Naming of the positive stimuli after the discrimination response enhanced performance. However, naming the negative stimuli depressed performance at the first- and third- but not at the sixth-grade

level. It would seem that the naming of the negative stimuli would depress performance because it increases the recall of the incorrect response, but with sixth-grade children and adults (Carmean and McLauchlan, 1967) performance is not depressed by the addition of one transformation or mnemonic activity--the choosing of the response that the subject did not say. One possible suggestion for extending the present finding (of no background frequency effect in second graders) would be to present only the correct item in the feedback phase thus directing the child's attention to rehearse or engage in some mnemonic activity with only the correct item. The most reasonable explanation for these differences cannot be answered in this study, only implied. What can be substantiated is that second- and fourth-grade children are operating differently with regard to background frequency effects in this verbal discrimination task.

Pictures Versus Words

The picture-over-word effect, as reported in previous literature, has been supported in this study for both nonsense pictures made meaningful (by adding labels) and real pictures.

Effects of Meaningfulness

It seems, based on the results of this experiment, that the meaningfulness of pictorial materials does not affect discrimination learning in the same manner as found with verbal materials (Ghatala et al., in press). (Note, however, that even though the comparison of nonsense pictures-no labels with real pictures-no labels was not significant, it was in the predicted direction.) One suggestion is that in lieu of meaningfulness subjects may be coding on visual properties of the figures in order to make the discrimination. Another alternative is that the nonsense pictures were not meaningless enough. Perhaps asking a subject if he can give a label to the nonsense form is not a

strong enough criterion. If these nonsense pictures were somewhat meaningful there would be a greater tendency for the subjects (even second graders) to label them spontaneously. This possibility is very strong if one looks at the comparison of nonsense-no labels ($\bar{X}$ = 17.7) and nonsense-high frequency labels (18.6). There seems to be little increment in learning when these nonsense forms are labeled or essentially made more meaningful. Also, anecdotally, a few children reported a couple of items as being identifiable (e.g., that looks like a "fish") in the nonsense-no label condition.

Implications for Further Research

There are several implications for further research which are being considered by the author. One proposed study involves fourth-grade children as subjects. The purpose is to investigate possible developmental trends with the nonsense and real picture conditions in discrimination learning. From the present experiment, the nonsense materials are being reconstructed to be more abstract in nature to attempt to reduce spontaneous labeling. The list is being lengthened to control for ceiling effects with these older children. One other possible cue to labeling the nonsense pictures spontaneously is by the instructions that the subjects would see pairs of "things". "Things" to a second-grade child could represent real things rather than the intended abstract forms. Therefore, the instructions are going to be revised for the fourth graders. Instead of "things" the children will be told that they are going to see some pairs of "funny-looking shapes". The remainder of the procedure will be essentially the same as in the present experiment.

Since background frequency may become a more potent variable with increasing age, it might be interesting to examine the relationship between the relative frequency judgments of the second-grade children and the fourth-

grade children, i.e., to look at the judged distances between the high-frequency and low-frequency verbal labels. Perhaps the high-frequency and low-frequency labels are perceived as closer together in the second-grade child's verbal experience as compared to that of the fourth grader.

One further proposal to be raised involves directing the young child's attention to the correct item in the feedback phase of the verbal discrimination task. Ingison and Ekstrand (1970) have demonstrated with college students that presenting only the correct item in the feedback phase leads to faster learning. This guiding of the child's attention to the correct item may be accomplished by either presenting only the correct item, E pronouncing the correct item, or having the child rehearse the correct item. This may aid the child in gaining the appropriate input of the high and low frequency items.

As this study has demonstrated, there are many difficulties in using these nonsense-like materials but it has also pointed out possible important developmental trends in the effects of background frequency on discrimination learning.

Chapter VI

SUMMARY

This experiment was conducted to assess the effects of certain stimulus variables on the discrimination learning of young children (second graders). One variable of interest consisted of the mode of presentation (pictures versus words). Materials were further delineated into real pictures with no labels; nonsense-type pictures with either no labels, high-frequency labels or low-frequency labels; and high- and low-frequency printed words.

From previous research and theorizing, it was predicted that: (i) pictures would be easier to discriminate than words; (ii) labeling nonsense-type pictures would increase performance by increasing meaningfulness; and (iii) low-frequency words and labels would be better discriminated than high-frequency words and labels.

In general, it was found that the picture-over-word effect was operating, although not as strongly as in previous research with older subjects. There was a nonsignificant increase in performance due to labeling nonsense-type pictures; and there was little or no indication of a word-frequency effect.

The implications of these results were discussed in conjunction with additional data with slightly older children (fourth graders). With these children the frequency effect (low- over high-frequency words) was demonstrated. Questions for future research focused on developmental differences as related to frequency effects.

BIBLIOGRAPHY

Bernbach. H. A. The effect of labels on short-term memory for colors with nursery school children. Psychonomic Science, 1967, 7, 149-150.

Brown, A. L. & Scott, M. S. Recognition memory for pictures in preschool children. Journal of Experimental Child Psychology, 1971, 11, 401-412.

Bush, E. S. & Cohen, L. B. The effects of relevant and irrelevant labels on short-term memory in nursery school children. Psychonomic Science, 1970, 18, 228-229.

Carmean, S. L. Effects of pattern of auxiliary activity on discrimination learning of children. Child Development, 1969, 40, 927-934.

Carmean, S. L. & McLachlan, J. C. Visual discrimination learning: Interactions of auditory input pattern, verbalization, and instructions. Psychonomic Science, 1967, 8, 311-312.

Carroll, J. B., Davies, P., & Richman, B. Word frequency book. New York: American Heritage Publishing Co., Inc., 1971.

Corsini, D. A., Pick, A. D., & Flavell, J. H. Production of nonverbal mediators in young children. Child Development, 1968, 39, 53-58.

Cross, H. A. & Vaughter, R. M. The Moss-Harlow effect in preschool children as a function of age. Journal of Experimental Child Psychology, 1966, 4, 280-284.

Deichmann, J. W., Speltz, M. B., & Kausler, D. H. Developmental trends in the intentional and incidental learning components of a verbal discrimination task. Journal of Experimental Child Psychology, 1971, 11, 21-34.

Ekstrand, B. R., Wallace, W. P., Underwood, B. J. A frequency theory of verbal discrimination learning. Psychological Review, 1966, 73, 566-578.

Flavell, J. H. Developmental studies of mediated memory. In H. W. Reese and L. P. Lipsitt (eds.), Advances in child development and behavior, Vol. 5. New York: Academic Press, 1970.

Flavell, J. H., Friedrichs, A. G., & Hoyt, J. D. Developmental changes in memorization processes. Cognitive Psychology, 1970, 1, 324-340.

Ghatala, E. S. & Levin, J. R. Developmental differences in frequency judgments of words and pictures. Journal of Experimental Child Psychology, 1973, 16, 495-507.

Ghatala, E. S. & Levin, J. R. Discrimination learning as a function of differences in materials: A proposed explanation. Memory and Cognition, 1974, 2, 395-400.

Ghatala, E. S., Levin, J. R., & Makoid, L. A. A clarification of frequency effects in children's discrimination learning. Memory and Cognition, in press.

Ghatala, E. S., Levin, J. R., & Wilder, L. Apparent frequency of words and pictures as a function of pronounciation and imagery. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 85-90.

Glucksberg, S. & Krauss, R. M. Studies of the development of interpersonal communication. Paper presented at the Biennial Meeting of the Society for Research in Child Development, New York, 1967.

Goulet, L. & Hoyer, W. The effects of verbalization on verbal discrimination learning and associative recall in young children and adults. Journal of Experimental Child Psychology, 1969, 7, 434-439.

Goulet, L. & Sterns, H. L. Verbal discrimination learning and transfer with verbal and pictorial materials. Journal of Experimental Child Psychology, 1970, 10, 257-263.

Hagen, J. W., Meacham, J. A., & Mesibov, G. Verbal labeling, rehearsal, and short-term memory. Cognitive Psychology, 1970, 1, 47-58.

Ingison, L. J. & Ekstrand, B. R. Effects of study time, method of presentation, word frequency, and word abstractness on verbal discrimination learning. Journal of Experimental Psychology, 1970, 85, 249-254.

Kingsley, P. R. & Hagen, J. W. Induced versus spontaneous rehearsal in short-term memory in nursery school children. Developmental Psychology, 1969, 1, 40-46.

Levin, J. R., Ghatala, E. S., & Wilder, L. Picture-word differences in discrimination learning: I. Apparent frequency manipulations. Journal of Experimental Psychology, 1974, 102, 691-695.

Milgram, M. A. & Furth, H. G. The effect of verbalization and conceptual grouping on recall of children at three age levels. (Abstract) American Psychologist, 1963, 18, 350.

Paivio, A. Imagery and verbal processes. New York: Holt & Co., 1971.

Paivio, A. & Rowe, E. J. Noun imagery, frequency, and meaningfulness in verbal discrimination. Journal of Experimental Psychology, 1970, 85, 264-269.

Rowe, E. J. Discrimination learning of pictures and words: A r[illegible] tion of picture superiority. Journal of Experimental Child Psychology, 1972, 14, 303-312.

Rowe, E. J. & Paivio, A. Discrimination learning of pictures and words. Psychonomic Science, 1971, 22, 87-88.

Rowe, E. J. & Paivio, A. Word frequency and imagery effects in verbal discrimination learning. Journal of Experimental Psychology, 1971, 88, 319-326.

Shepard, R. N. Recognition memory for words, sentences, and pictures. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 156-163.

Spence, K. W. The nature of discrimination learning in animals. Psychological Review, 1936, 43, 427-449.

Spence, K. W. & Hull, C. Behavior theory. In W. S. Sahakian (ed.), Psychology of learning. Chicago: Markham Publishing Co., 1970.

Standing, L., Conezio, J., & Haber, R. N. Perception and memory for pictures: Single-trial learning of 2500 visual stimuli. Psychonomic Science, 1970, 19, 73-74.

Thorndike, E. L. & Lorge, I. The teacher's word book of 30,000 words. New York: Bureau of Publications, Teachers College, 1944.

Underwood, B. J., Broder, P.K., & Zimmerman, J. Retention of verbal discrimination lists as a function of number of prior lists, word frequency, and type of list. Journal of Experimental Psychology, 1973, 100, 101-105.

Underwood, B. J. & Schulz, R. W. Meaningfulness and verbal learning. Philadelphia: Lippincott, 1960.

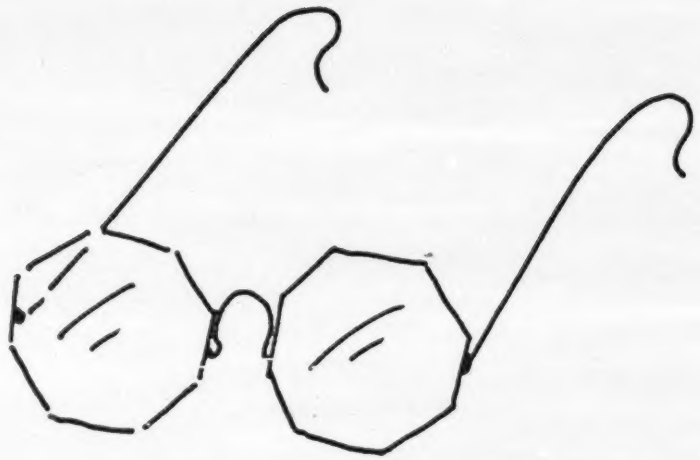
Wallace, W. P. Verbal discrimination. In C. P. Duncan, L. Sechrest, and A. W. Melton (eds.), Human Memory: Festschrift for Benton J. Underwood. New York: Appleton-Century-Crofts, 1972.

Ward, W. C. What's in a name? Processes responsible for the labeling effect on memory in nursery school children. Paper presented at the Meeting of the Society for Research in Child Development, Minneapolis, April 1971.

Wilder, L. & Levin, J. R. A developmental study of pronouncing responses in the discrimination learning of words and pictures. Journal of Experimental Child Psychology, 1973, 15, 278-286.

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

APPENDIX A



EASILY RECOGNIZABLE
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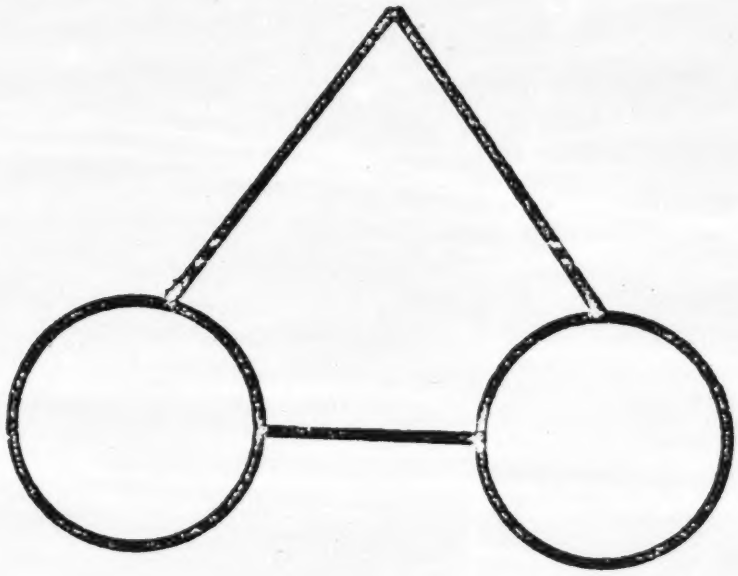

HIGH FREQUENCY LABEL

GLASSES

LOW FREQUENCY LABEL

SPECTACLES

APPENDIX B

Words (High and Low)

I'm going to show you some words. There will be two words on each page. I want you to try to remember the word which has a star below it. For example, when I show you this pair of words "person" and "banana," right after you'll see that the word "banana" has the star beneath it and you should try real hard to remember it because later on I'll show you the same pair of words "person" and banana" again and I want you to pick the word that you think had the star under it from before. Which one was it here? Point to it. Now I'm going to show you a whole bunch of words. There will be two words on each page. After each pair of words you will see which one has a star under it. Try to remember the words which have the stars under them.

Study Trial

Now I'm going to show you the same pairs of words again. This time I want you to pick the word that you think had the star under it. After you pick, I'll show you if you were right. The pairs of words are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation I

Now I'm going to show you the same pairs of words again. This time I want you to pick the word that you think had the star under it. After you pick, I'll show you if you were right. The pairs of words are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation II

Pictures - Nonsense - No Labels (High and Low)

I'm going to show you some things (and tell you what they're supposed to be). There will be two things on each page. I want you to try to remember the thing which has a star below it. For example, when I show you these two things (one that looks like a "person" and the other that looks like a "banana") right after you'll see that this thing (that looks like a "banana") has a star beneath it and you should try real hard to remember it because later on I'll show you the same pair of things again and I want you to pick the thing that you think had a star under it. Which one was it here? Point to it.

Now I'm going to show you a whole bunch of things. There will be two things on each page. After each pair of things you will see which one has a star under it. Try to remember all the things which have stars under them.

Study Trial

Now I'm going to show you the same pairs of things again. This time I want you to pick the thing that you think had the star under it. After you pick, I'll show you if you were right. The pairs of pictures are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation Trial I

Now I'm going to show you the same pairs of things again. This time I want you to pick the thing that you think had the star under it. After you pick, I'll show you if you were right. The pairs of pictures are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation Trial II

Pictures - Real - No Labels

I'm going to show you some pictures. There will be two pictures on each page. I want you to try to remember the picture which has a star below it. For example, when I show you this pair of pictures, right after you'll see that the one picture has a star beneath it and you should try real hard to remember it because later on I'll show you the same pair of pictures again and I want you to pick the picture you think had the star under it from before. Which one was it here? Point to it. Now I'm going to show you a whole bunch of pictures. There will be two pictures on each page. After each pair of pictures you will see which one has a star under it. Try to remember the pictures which have the stars under them.

Study Trial

Now I'm going to show you the same pairs of pictures again. This time I want you to pick the picture that you think had the star under it. After you pick, I'll show you if you were right. The pairs of pictures are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation I

Now I'm going to show you the same pairs of pictures again. This time I want you to pick the picture that you think had the star under it. After you pick, I'll show you if you were right. The pairs of pictures are in different order now, so be careful. (Do you have any questions?) Here we go!

Anticipation II

APPENDIX C

Definitions

I'm going to tell you some words and all I want you to do is to tell me what you think they mean. Listen carefully, I want you to tell me what you think a _____ is. What's a _____? What does _____ mean?

Insufficient answers -- Can you tell me something about it? Can you tell me more?

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